AUTONOMOUS SYSTEMS INITIATIVE

ASI Newsletter Volume 2 Issue 5 May 2021

Welcome! We are excited to tell you about the upcoming ASI Annual Symposium on June 2nd. **Dr. Ibrahim Gedeon**, Chief Technology Officer at TELUS is the Keynote Speaker, and the day includes an industry discussion panel featuring cross-sector industry representatives who will speak to the future of automation in their areas.

For more information, see page 3 on the newsletter, or alternatively you can visit our website. To register, please go to the Eventbrite page.

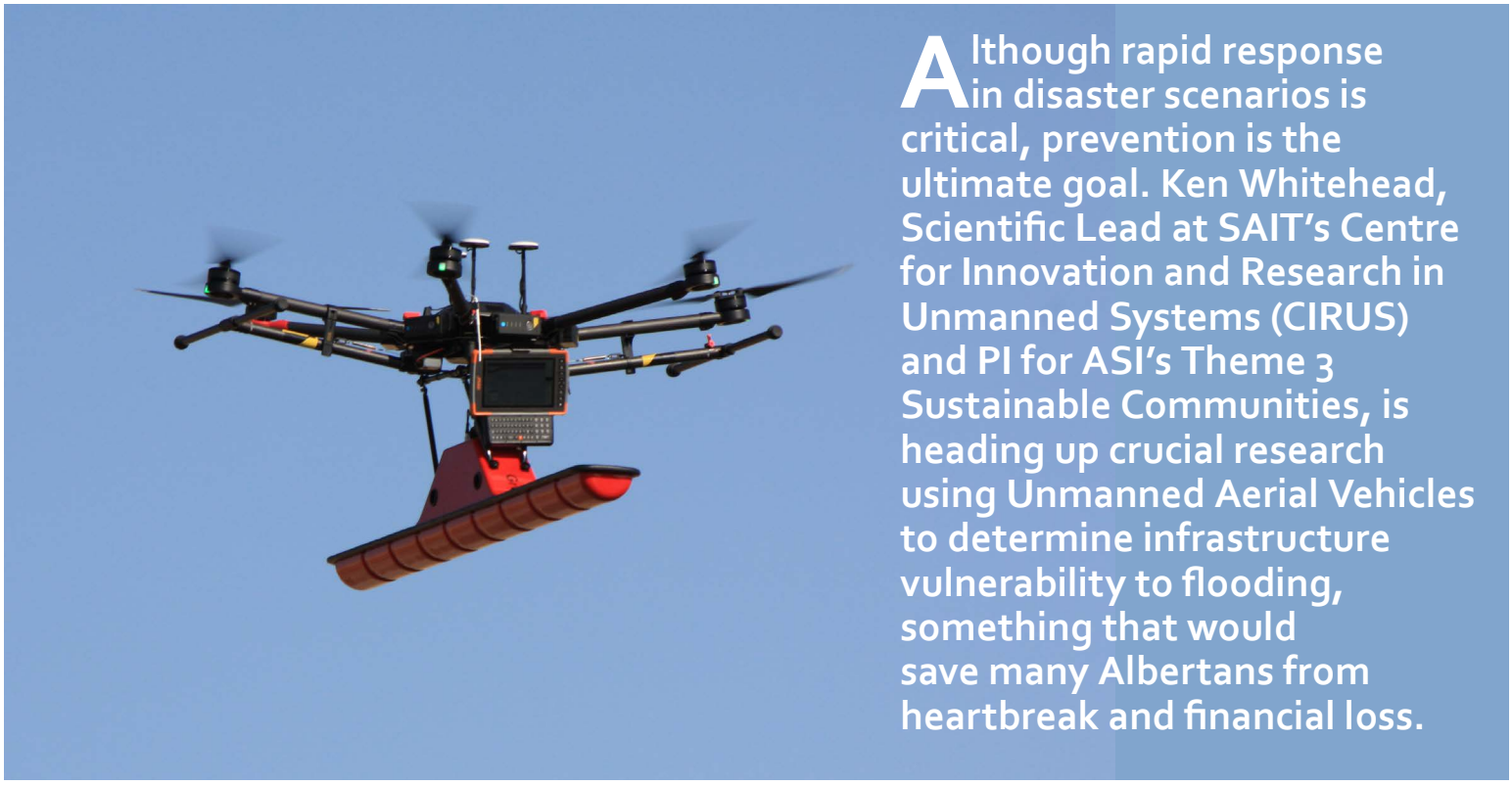
We look forward to seeing you there!

Call for judges

ASI are currently seeking judges for our upcoming Annual Symposium student poster competition. Research, industry or policy expertise in any area of automation is welcome. Judges will be given a matrix for assessment as all presentations will be available asynchronously.

If you are interested in helping guide our future generation of automation experts, please contact ASI Project Manager, Dana Chamot at dchamot@ualberta.ca

Research Spotlight



Although rapid response in disaster scenarios is critical, prevention is the ultimate goal. Ken Whitehead, Scientific Lead at SAIT's Centre for Innovation and Research in Unmanned Systems (CIRUS) and PI for ASI's Theme 3 Sustainable Communities, is heading up crucial research using Unmanned Aerial Vehicles to determine infrastructure vulnerability to flooding, something that would save many Albertans from heartbreak and financial loss.

Large-scale flooding events are on the rise across the world. Alberta itself has seen several flooding disasters in recent years, most notably in Calgary in 2013 and more recently in Fort McMurray. And, while we are learning from our responses to those events, the clear preference is to safeguard our infrastructure before disaster strikes.

Dr. Ken Whitehead and the CIRUS research team at Southern Alberta Institute for Technology (SAIT) see Unmanned Aerial Vehicles (UAVs) as a key piece of technology to help planners determine vulnerability to flooding. Using high-resolution Light Detection and Ranging (LiDAR) and Ground-Penetrating Radar (GPR) transported by the UAVs, the project seeks to map floodplains and riverbed depths in flood-prone areas, helping calibrate provincial hydrological models and identify infrastructure at risk from flood events.

The CIRUS researchers are also testing the applicability of this technology for river bottom surveys. They have already successfully demonstrated the concept on the Bow River and hope to try it at an operational scale using Beyond Visual Line of Sight (BVLOS) UAV flight in the coming year. “It’s really exciting,” enthuses Dr. Whitehead, an expert in UAVs and drones for the environment. “This is a new application for UAVs, where we are now able to fine-tune and improve the precision of regional hydrological models and also identify infrastructure at risk of being impacted during flooding events. CIRUS was able to fly the first UAV-mounted GPR system in North America as part of this project. Alberta is taking a leading role in this important application.”

And, like much of our work at ASI, this project is made possible through key collaborations. Industry partner Earth Scan Technologies has provided the GPR sensors, and the Alberta Government is assisting the research team in identifying the province’s critical areas prone to flooding.

The team is gearing up for Summer 2021 when they will carry out multiple data collections along sections of the Bow River and develop algorithms for integrating the LiDAR and GPR data to facilitate the Government of Alberta to fine-tune provincial hydrological models. They will then begin developing an infrastructure vulnerability database, including floodplain and riverbed mapping, and aim to test the methodology at operational scales in the Summer of 2022 by surveying a section of the Athabasca River near Fort McMurray.

With the improvement in provincial hydrological modelling and flood prediction, the Government of Alberta, along with local and municipal governments, will benefit from improved flood prediction and the identification of infrastructure at risk. But ultimately, the real beneficiaries will be developers and industry looking to find suitable and safe locations for site development. “In the future, UAV-mounted and in-situ sensors will become commonplace for monitoring natural disasters, such as flood events,” says Dr. Whitehead. “This will allow stakeholders at all levels to make informed decisions on the location of new developments and critical infrastructure.”

Having this knowledge in hand makes a more secure future for all Albertans.

The team for Determining Infrastructure Vulnerability to Flooding using Unmanned Aerial Vehicles, based at SAIT, includes Dr. Ken Whitehead, Scientific Lead, Centre for Innovation and Research in Unmannned Systems; Rick Duchscher, Instructor and UAV Pilot; Sara Ashoori, Research Asst.; Alireza Mardan, Asst. UAV Pilot.

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AUTONOMOUS SYSTEMS INITIATIVE

Long-term Vision

Automated Futures

Short-term Goals

June 2nd, 2021
9am to 3pm

Autonomous systems are the foundations of current technological advancement in both our industries and communities. As those who are at the forefront of this technology, we have both short-term goals for development and deployment as well as a long-term vision of the future. Do our visions align? Will our short-term goals lead us toward our long-term aims? Will the current work being undertaken in different sectors integrate into a holistic, automated future?

In this symposium, we will address these issues through a dialogue that connects different areas of research and development on autonomous systems.

Keynote Presenter:

Ibrahim Gedeon
Chief Technology Officer, TELUS

Other guest speakers include:

Chris Nash, President, AMTA
Nicole Janssen, Co-CEO, AltaML
Luc Pouliot, COO and CTO, PolyControls
Satvinder Flore, EVP Energy, Resources & Industry, WSP
Debi Larkin, Senior Application Specialist, 3M Canada

For continually updated information on the symposium, go to **our website**

Register for this *free* event at **our Eventbrite page**

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HQP Profile

The ASI research team for Theme 4 Healthy Communities is harnessing automation's potential to improve our lives and well-being. This month we meet Ph.D. candidate Jason Wong who tells us about his role in matching cutting-edge automation with the detection and monitoring of Adolescent Idiopathic Scoliosis.

When we think of automation, healthcare isn't the first field that comes to mind. And yet, the application of autonomous systems can profoundly impact the diagnosis and treatment of many different diseases and conditions.

Currently working under Dr. Edmond Lou in Electrical Engineering at the University of Alberta, Jason Wong recognized the potential of machine intelligence in health.

"I was always fascinated with the biomedical engineering breakthroughs I saw in the news, so I was already certain I wanted to work in this field going into university. My interest in my research area began back in my undergraduate when I developed the code to build a 3D model of a body to facilitate brace creation used in the treatment of scoliosis."

Scoliosis is a condition where a person's spine is characterized by lateral curvature and vertebral rotation. Typically, radiography is used to measure the severity of the spinal deformity, which exposes patients to high radiation levels. Studies have found that patients diagnosed with scoliosis as adolescents are five times more likely to develop cancer later in life, and girls specifically have a 70% excess risk of dying from breast cancer when compared with the general population.

Recently, ultrasound has been accepted as an alternative radiation-free method of imaging. The issue, though, is that it is more difficult to interpret and measure. Jason's current research focuses on developing a machine-learning model to automate the measurement procedure on these spinal ultrasound scans. He will use a convolutional neural network to identify spinal landmarks and facilitate measurement automation.

The hope is for this measurement automation system to be used in clinical practice and to further cement ultrasound as a valid imaging method for scoliosis, thereby reducing cancer risk in children with scoliosis.

"The idea that you are working towards a product or technique that can improve the quality of life of patients or even potentially save lives is rewarding and keeps you motivated. Additionally, with the recent developments in the field of computer engineering (particularly machine learning), there is so much more to explore in its applications to the biomedical field, so being at the frontier of this research is incredibly exciting to me."

Jason is confident that these systems can only improve the quality of care. "I think that autonomous systems will play a huge part in the future, particularly in the biomedical field. I do not foresee them replacing health professionals by any means, but I certainly think that we will see a shift towards professionals leveraging these systems to improve patient care."

He hopes his research will launch a career in computer engineering for medicine. Specifically, he says he'd like to work in software development, focusing on the intersection between artificial intelligence and biomedicine and may have to relocate to a larger tech hub such as Vancouver or Toronto.

But, he still has time to decide with another two years before he graduates.

Meanwhile, the recent advancements in computer engineering and their tangible benefits continue to drive him. "I certainly think we can do a lot to advance health care, making clinicians' jobs more efficient, increasing life expectancy, and improving patients' quality of life."

Contact Us

For more information on the Autonomous Systems Initiative (ASI):

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